

## THE AUTUMN MIGRATION OF THE BALCKCAP (*SILVIA ATRICAPILLA* L.) IN THE DANUBE-BEND

G. LÖVEI

*Department of Zoology, Attila József University, Szeged*

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### Abstract

The autumn migration of the blackcap was investigated in the ringing camp of the Hungarian Ornithological Association, in Kisoroszi (47° 47' N; 19° 03' E), in the years 1974–1976. Using wing and tail sizes, multivariate analysis was carried out and the regression of wing length, resp. wing pointedness calculated, shown by the date of passage. Relying upon these findings, the population composition of the migratory birds and the migration dynamics of populations were discussed and biometric data published. By means of regression analysis, some differences can be demonstrated in the migration behaviour of sexes.

### Introduction

The blackcap (*Sylvia atricapilla*) is, after whitethroats (*S. communis*) being strikingly reduced in numbers (WINSTANLEY, SPENCER & WILLIAMSON 1974, STOLT & ÖSTERLÖF 1975), our most frequent warbler species today. We know from migration data and experiments (BERTHOLD & DORKA 1969, BERTHOLD, GWINNER & KLEIN 1970, KLEIN, BERTHOLD & GWINNER 1971, 1973, BERTHOLD 1976, ZINK 1973) that the blackcap has no definite instinct migration programme. According to the wintering area, the European populations can be divided as follows: north of 52°-N, the nesting birds migrate in a broad front (Breitfrontzug) towards the south, in the direction  $188^{\circ} \pm 27^{\circ}$ . At the nesters south of 52°-N and east of 15°-E, the direction of migration is  $142^{\circ} \pm 18^{\circ}$ , at those west of 15°-N it is  $196^{\circ}$  ( $E=0^{\circ}$ ). The most crowded gathering place is the Near-East, from where a part of them keep on migrating to Africa. The migration in Eastern Europe begins and ends earlier than in Western Europe begins and ends earlier than in Western Europe where the migration peak of the spring migration is 0.84 days late annually and that of the autumn migration advances about 0.54 days. The cause of this may be that since the Nineteen-Fifties the blackcap became more numerous in Europe. And, as first those nesting in more northern places do migrate and then those nesting in more southern places, this brought about a change in their migration peaks. In the wintering areas, the northern nesters can be found at the southern fringes, and those being more eastward in the nesting sites, preserve their more eastern situation in the wintering areas, as well.

\* Researches of the Hungarian Ornithological Association, Proceeding 2.

All these are mostly founded on data obtained from Northern, Central and Western Europe. About the populations in Eastern Europe there are only sporadic informations. There have so far been only nine Hungarian ringed blackcaps reported back, all of these from the Near-East and Cyprus. It is to be expected on the basis of the foregoing that there migrate more European populations into their winter-quarters over this country, possibly along the Danube (KLEIN, BERTHOLD, GWINNER 1973).

Although from the Nineteen-Sixties many publications have dealt with the biometric elaboration of the migration of birds (e.g. SCOTT 1962, BUSSE 1968, 1972a, 1976b, NIEMEYER 1969a, b, BLONDEL 1967, etc.), these were generally made with an univariate analysis. There were only a few attempts with taking into consideration together more than one point of view (BUSSE 1968, 1976a).

In my work, there were taken into consideration five sizes at the biometrical evaluation. These were evaluated together, with what the safety of separating the single populations could be increased well.

From among the biometrical elaborations the older data can generally not be used because the majority of these were recorded from specimens in museums and another method was used (SVENSSON 1972, WILLIAMSON 1972). I deemed it, therefore, useful to publish the measured biometric characteristics, as well.

### Materials and Methods

The material of investigation was collected in Kisoroszi (47° 47' N; 19° 03' E), at the northern point of the Szentendrei-Island, by the collective, working in the ringing camp of the Hungarian Ornithological Association. It consists in the Autumn of 1974/1975 collected and measured 290 blackcaps. The birds were captured with mist nets laid in three phytocoenoses of the area: (1) *Salicetum triandrae* willow beds, (2) *Pruno-spinosae-Crataegetum* hawthorn bush, and (3) *Festuco-Pinetum* pinewood plantation. There were used nets of different productions and sizes but of identical mesh sizes (15×15 sq. mm), with a total surface changing between 135–640 sq. m. Their ratio was the same in the single coenoses, in the former sequence 3:2:1.

At controlling and measuring, the methods of the Baltic Action were followed (BUSSE & KANIA 1970, BUSSE 1974). There were measured, resp. recorded: the assessed condition (this was measured only in 1976), the wing length, tail length, the quantitative wing formula, the distance between the longest primary and the first secondary, the difference between the first primary and the primary coverts (being positive if the primary is longer). Bill and tarsus were not measured because of technical causes.

At the biometric evaluation those described by BUSSE (1972b) were followed. The elaborateness of distribution was restricted by the existing size of samples. The comparison between the groups was carried out by Hotelling's T-square test (TATSUOKA 1971). The other calculations were performed on the basis of SvÁB (1967).

### Results and their discussion

The blackcap migrates in the night. The course of its migration was concluded from the number of those captured. From the graph of capturing (Fig. 1) three waves could be separated, coinciding year by year:

	I	II	III
1974	24 August–4 Sept.	5–18 Sept.	—
1975	18 August–4 Sept.	5–13 Sept.	14–30 September
1976	20 August–3 Sept.	4–12 Sept.	13 Sept.–9 August.

It is to be noted that the beginning of wave I is the day of the opening of the camp and not a real day of commencement. In the same way, in 1974, the end of wave II was on the 18th because of closing the camp. In 1974, there are measurement data only after the first of September.

At the investigation of BERTHOLD, BAIRLEIN and QUERNER (1976), structure and size of collecting were already considerably changed by transferring or omitting a net. From the map published by them is, anyway, to be seen that comparatively few nets were laid under varied conditions of phytocoenoses. Their reservations cannot be accepted in our larger homogenous phytocoenosis-units. We have used constant net sites but the nets lay in alternating numbers of these. The structure of collecting can be considered as similar, this was not influenced by the alternating number of nets. The data of collecting were corrected to the net surface (Fig. 1).

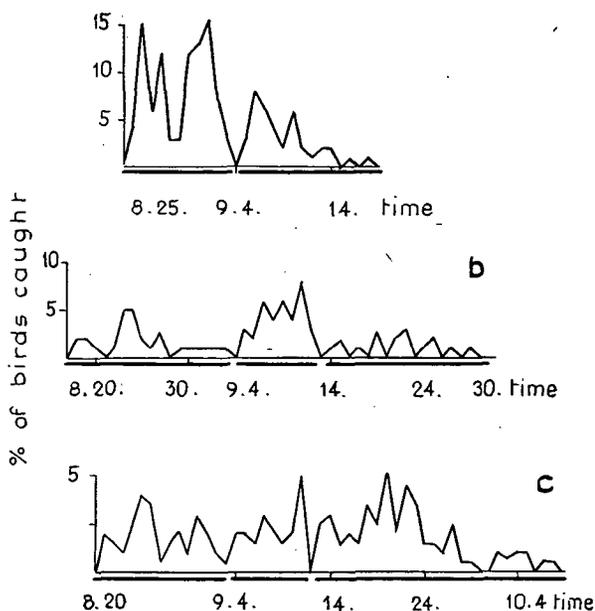


Fig. 1. Autumn migration of blackcap at Kisoroszi. a: 1974, b: 1975, c: 1976. Results are corrected to net surface.

The migration curve gives well-separable waves which were further on treated as a unit. Although the curve of the single waves is of normal distribution for all the variables investigated, it still did not consist, in some cases, of a single population.

Such a situation has already been known since an earlier date (BUSSE, 1976a, LÖVEI 1977.)

The matter in question is, in this case, the investigation of the morphological variation. It was namely supposed on the basis of previous researches that populations originating from different geographical sites may migrate over the area investigated. The selection of the statistical differences between populations, resp. of the factors showing these differences would require the previous investigation into several (40 to 60) morphological characters (THORPE 1976). This is possible in case of investigating into a museum material. In case of living birds, however, the number of measurable data is restricted by the intention of releasing them undamaged and by the large number of birds during the unit of time.

Starting from this consideration, we have applied the widely accepted measuring methods of the Baltic Action (BERTHOLD 1973, BUSSE 1974). The effectiveness of investigations can be increased if the factors exposed to the adaptative pressure are investigated. These are, in case of birds, at least the wing, the bill, and the tarsus. The last two factors have not been measured. But in case of the wing, four sizes were stated that were earlier suggested for characterizing wing pointedness (AVERILL 1920, 1925, RENSCH 1938, STEGMAN 1940, 1954, 1961, 1962, KIPP 1958, 1959, HOLYNSKI 1965).

It is to be supposed that a more pointed wing means an adaptive advantage and that this pointedness is proportionate to the distance made during migration, if only the way of taking nourishment does not demand much flying (like e.g. at swallows) and if the populations of the species live in different parts of the area of spreading, in similar habitats and take similar nourishments, i.e. if, apart from the time of migration, there is no significant difference in the energetics of populations.

It is also supposed that the first-year birds obtain, for the date of migration, the wing pointedness characteristic of the population, if only there is no difference in the migration behaviour of age-groups (cf. a proper example for that at KIPP, 1954).

Blackcaps are insectivores living in bushy habitats. The richness in species of the potential food, its mean size and size pattern do not show, at least, a gradient increasing in northern direction. The energy devoted to taking nourishment does, therefore, not decrease in northern direction (SCHOENER & JANZEN 1968), SCHOENER 1971). We think, therefore, that the distance made at migration is a considerable force in the determination of the wing pointedness of the European blackcap population. This means, in accordance with the data up till now (KLEIN, BERTHOLD & GWINNER, 1973) that in the north the wings of blackcaps are more "pointed" because the northerners must fly much more to the wintering sites and back.

For investigating the mechanism of migration, there was carried out the regressive investigation of the wing length and Holynski's wing-pointedness index (e-value, HOLYNSKI 1965), during the autumn migration (Figs. 2-5) and these were compared with the data of KLEIN, BERTHOLD & GWINNER (1973). A better result is obtained by investigating into the wing pointedness than into the wing length (Table I). The migration mechanism published by KLEIN, BERTHOLD & GWINNER (1973) is confirmed by the regressive straights concerning layers. Wing pointedness gives a much steeper regressive straight (Table I) than according to the mentioned publication (Table 7, Figs. 22, 23 in KLEIN, BERTHOLD, & GWINNER, 1973).

Table I. *Sylvia atricapilla*, Kisoroszi, 1974-1976. Regression analysis, showing the connection of the mean wing length and wing pointedness with the date of migration

Sex	Measurement	b	r	p for $r \neq 0$	Confidence 5 p. c.	limits 1 p. c.
Male	wing length	0.0717	0.3649	<0.001	$\pm 0.2528$	$\pm 0.3333$
	wing pointedness	0.3995	0.2148	<0.01	$\pm 0.3029$	$\pm 0.3993$
Female	wing length	-0.0946	-0.5197	<0.001	$\pm 0.0832$	$\pm 0.1096$
	wing pointedness	-0.2523	-0.3625	<0.001	$\pm 0.0786$	$\pm 0.1036$

At males, both wing length and wing pointedness give a regressive straight of positive steepness differing from zero significantly (Table I, Figs. 2-3), what refers to the different migration mechanism of males.

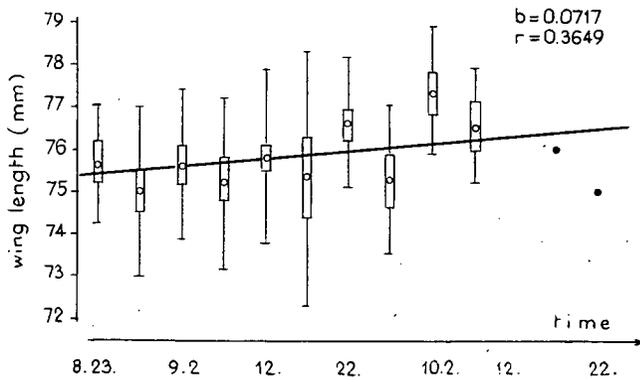


Fig. 2. The mean size of the wing length of the male blackcaps, with mean failure and size pattern per 5 days.

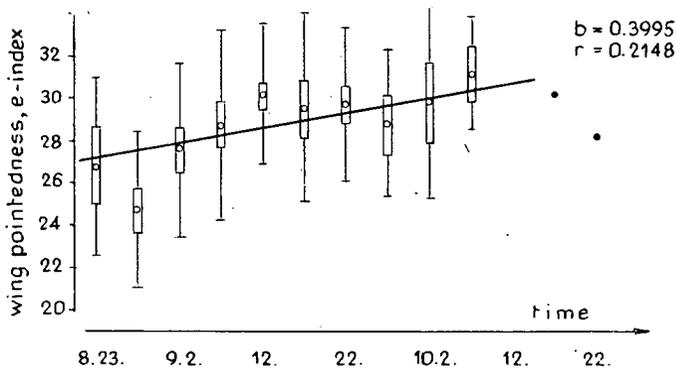


Fig. 3. Change in the wing pointedness of the male blackcaps, like in Figure 2.

Table II. *Sylvia atricapilla*, Kisoroszi, 1974–1976. Biometric evaluation of the recorded sizes, separated in years, waves, and sexes, at 95 percent confidence level. Data: the mean size  $\pm$  size pattern (above); size pattern, sample size (below)

Year, wave, sex	1st primary	Wing length	Tail length	Primary-secondary distance	Wing pointedness, e-index
♂, I.	4.00 $\pm$ 1.60	76.00 $\pm$ 1.42	63.38 $\pm$ 1.26	20.14 $\pm$ 1.46	29.86 $\pm$ 3.48
	1.73 7	1.69 8	1.51 8	1.57 7	3.76 7
II.	3.38 $\pm$ 0.91	74.88 $\pm$ 0.93	62.71 $\pm$ 0.96	18.88 $\pm$ 0.64	28.53 $\pm$ 2.47
	1.71 16	1.80 17	1.86 17	1.20 16	4.45 15
♀ I.	5.00 $\pm$ 1.76	74.83 $\pm$ 1.72	61.83 $\pm$ 2.34	19.50 $\pm$ 1.45	30.33 $\pm$ 4.44
	1.67 6	1.72 6	2.23 6	1.38 6	4.23 6
1974 II.	3.75 $\pm$ 1.05	76.17 $\pm$ 1.40	63.36 $\pm$ 1.05	18.92 $\pm$ 0.96	29.64 $\pm$ 1.57
	1.66 12	2.21 12	1.57 11	1.51 12	2.34 11
♂ I.	3.25 $\pm$ 0.86	74.00 $\pm$ 0.86	63.46 $\pm$ 1.74	18.33 $\pm$ 0.49	24.64 $\pm$ 2.41
	1.36 12	1.35 12	2.58 11	0.78 12	3.58 11
II.	3.40 $\pm$ 0.55	75.67 $\pm$ 1.04	63.47 $\pm$ 0.75	19.80 $\pm$ 0.76	29.53 $\pm$ 2.54
	0.99 15	1.88 15	1.36 15	1.37 15	4.58 15
III.	3.78 $\pm$ 1.26	76.33 $\pm$ 1.39	63.89 $\pm$ 1.94	19.89 $\pm$ 1.46	29.44 $\pm$ 2.96
	1.64 9	1.80 9	2.52 9	1.90 9	3.84 9
♀ I.	2.90 $\pm$ 1.10	75.00 $\pm$ 1.35	63.40 $\pm$ 1.48	19.70 $\pm$ 0.48	27.36 $\pm$ 2.02
	1.64 11	2.00 11	2.07 10	0.68 10	3.01 11
II.	4.40 $\pm$ 1.02	75.07 $\pm$ 1.10	63.33 $\pm$ 1.06	19.67 $\pm$ 0.65	29.92 $\pm$ 2.47
	1.84 15	1.98 15	1.92 15	1.18 15	4.09 13
1975 ♀, III.	3.33 $\pm$ 0.95	75.50 $\pm$ 1.31	63.92 $\pm$ 1.54	20.17 $\pm$ 0.37	27.18 $\pm$ 3.12
	1.50 12	2.07 12	2.43 12	0.58 12	4.64 11
♂, I.	3.77 $\pm$ 0.95	75.82 $\pm$ 0.79	63.27 $\pm$ 0.78	18.64 $\pm$ 0.50	26.65 $\pm$ 1.96
	2.14 22	1.79 22	1.75 22	1.14 22	4.20 20
II.	4.44 $\pm$ 0.57	75.83 $\pm$ 0.96	62.78 $\pm$ 0.93	19.42 $\pm$ 0.56	30.00 $\pm$ 1.27
	1.31 23	2.26 24	2.15 23	1.32 24	3.01 24
III.	3.86 $\pm$ 0.51	76.06 $\pm$ 0.70	63.77 $\pm$ 0.73	20.03 $\pm$ 0.50	29.69 $\pm$ 1.24
	1.52 36	2.06 36	2.09 34	1.45 $\pm$ 35	3.66 36
♀, I.	4.37 $\pm$ 0.57	76.00 $\pm$ 0.59	63.57 $\pm$ 0.76	19.13 $\pm$ 0.60	30.11 $\pm$ 1.48
	1.52 30	1.61 31	2.05 30	1.61 30	3.82 28
1976 II.	3.65 $\pm$ 0.50	76.65 $\pm$ 0.71	64.43 $\pm$ 0.76	19.48 $\pm$ 0.67	31.09 $\pm$ 1.62
	1.15 23	1.64 23	1.75 23	1.56 23	3.65 22
III.	3.50 $\pm$ 0.45	76.11 $\pm$ 0.82	64.08 $\pm$ 0.76	19.73 $\pm$ 0.43	29.36 $\pm$ 1.32
	1.34 36	2.45 37	2.28 37	1.28 37	3.91 36

The migration waves and within them the differences of sexes were investigated with multivariate analysis. The safeness of separation increased by two orders of magnitude opposite to the method using wing pointedness (LÖVEI 1977). The mean level is  $p=0.001$  and the differences are even at this level in most cases very significant.

The comparison of the various waves originating from different years has generally shown significant differences but sometimes random connections. It has been confirmed by this that the investigation into samples originating from different years leads to results of very changing and uncertain value. The causes of differences may equally be the different meteorological factors, inner controlfactors, the dissimilar mortality of populations, successful nesting or a mere chance. What is to be concluded from this investigation is only that the groups of males less differ from one another than those of layers. The cause of this may be not the smaller variability of males (it is, in fact, not smaller, cf. Table II) but that male migration is more influenced by external conditions than that of layers.

At investigating into the different waves, it is obvious that there is often a significant difference between males and layers, caught in the same wave, which is greater than, e.g., the difference from a previous group. This can most of all be seen in the year 1975 (Fig. 6). It is to be mentioned, too, that if in an area the males of a population migrate then — if both layers and males migrate in the same way — the layers of the population migrate in the same place, as well.

At the beginning of encampment the males did not migrate, as yet. Wing length and wing pointedness were equally of low value, similarly to that at the end of migra-

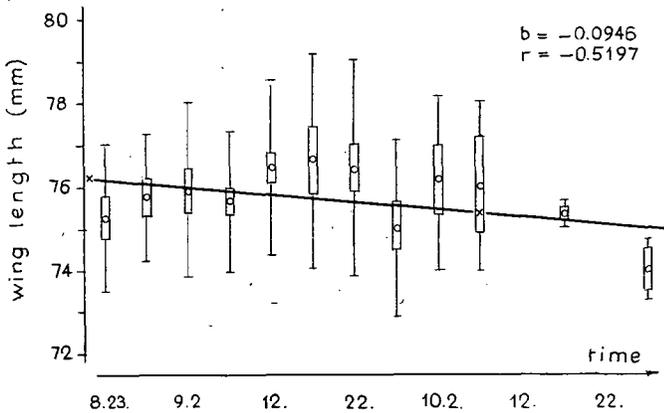


Fig. 4. Change in the wing length of the layer blackcaps, like in Figure 2.

tion (Figs. 2, 3, Table II). At the layers, there is already present a migrating population what is confirmed by that they differ from the males belonging to the same wave ( $p<0.001$ ). Wave III, however, shows a significant difference from both the first ( $p<0.01$ ) and the second ( $p<0.05$ ) layer waves, while the difference between male and layer waves III is not significant ( $p>0.1$ ). The results of 1974 and 1976 may be evaluated in a similar way.

I try to summarize the population pattern as follows: population I is represented by the males of wave I. These have been present in the area during the whole time of investigation. But the local males are "oppressed" by the higher number of those

arriving in populations 2 and 3 and cannot be observed later. By the males of wave II, population 2, and in a smaller part population 3, are represented. In wave III, population 3 dominates but, in smaller ratio, members of populations 2 and those of population 1 are also present.

In case of layers, in wave I, population 1 (local nesters) and, in the majority, population 2 are present, in wave II populations 3, 2, and 1, while in wave III the layers belonging to populations 3 and 1 migrate. Denseness of the nesting population is smaller and this is visible in case of layers, as well.

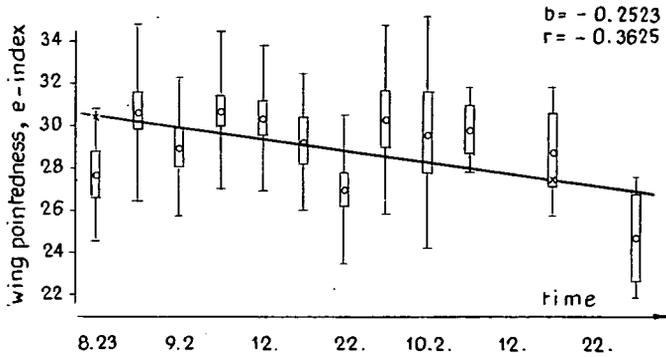


Fig. 5. Change in the wing pointedness of the layer blackcaps, like in Figure 2.

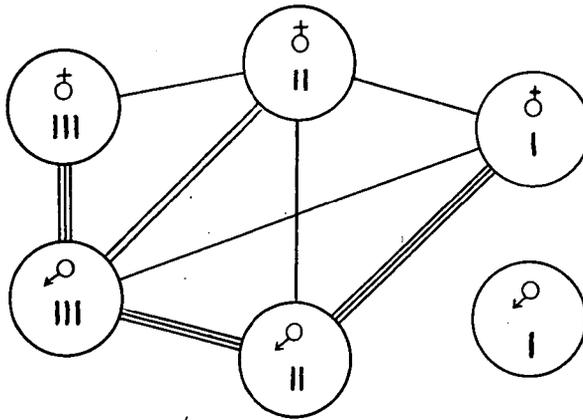


Fig. 6. Differences between the autumn migration waves with multivariate variance-analysis, 1975, Kisoroszi. I, II, III: migration waves. There is no junction-line. There is a significant difference at levels=0.001; -  $p < 0.01$ ; =  $p < 0.05$ ;  $p > 0.1$

The regressive straight of males was correspondingly found having a positive ascent because, at the beginning of the time of investigation, there were no male migrants. The regressive straight, started in about a fortnight after the beginning of the camp, was already negative because until that time so many migrants had arrived that the average was already influenced by their sizes.

## Conclusions

As seen above, the interpretation of migration, the analysis of the migration dynamics of populations are much more difficult tasks than those over the Baltic seaside. With us, mixed populations are present but the migration is not so massive as at the traditional European migration points.

The multivariate analysis is a serviceable method to separate populations. Mention must be made, however, of that in case of large samples there are given "too significant" differences, e.g. between any male-layer groups significant differences are calculated but that is biologically unacceptable.

It can be supposed on the basis of the structure of migration, of size and heterogeneous populations of waves that the populations caught at Kisoroszi did not show a typical migration curve, resp. that they interfered very much. The definite, from the point of view of population homogenous waves are missing, there cannot be observed any concentrated migration. The demonstrated populations either arrived from a not great distance or their migration was not concentrated by the valley or gallery forests of the Danube. It is imaginable that the populations arriving, so far, concentrated, scatter in the forests of the Danube-bend. The investigations should, therefore, be continued at a more southern point. On the basis of the results until now, the hypothesis of Klein, Berthold, and Gwinner cannot be considered as proved.

The regressive investigations performed according to sexes have demonstrated some differences in scheduling migration, the cause of which is to be looked for in the differences in force of the instinct migration programme.

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## A barátposzáta (*Sylvia atricapilla* L.) őszi vonulásáról a Dunakanyarban

LÖVEI G.

József Attila Tudományegyetem Állattani Tanszék, Szeged

### Kivonat

A barátposzáta őszi vonulását vizsgáltuk a Magyar Madártani Egyesület gyűrűzótáborában, Kisorosziiban (47° 47' N; 19° 03' E), 1974—76-ban. A szárnyról és a farokról vett méreteket használva többváltozós analízist végeztünk és a szárnyhossznak, illetve a szárnyhegyességnek az átvonulás időpontjával mutatott regresszióját számoltuk ki. Ennek alapján megvitattuk a vonulók populációösszetételét, a populációk vonulásdinamikáját, és biometriai adatokat közöltünk. A regresszióanalízissel különbség mutatható ki az ivarok vonulási viselkedésében.

## Jesenja seoba *Sylvia atricapilla* L. na području Dunakanyar

G. LÖVEI

Katedra za zoologiju Univerziteta JATE, Szeged

### Abstract

Tokom jeseni 1974—1976. god., u okviru rada Ornitološkog udruženja za prstenovanje ptica, pratili smo seobu *Sylvia atricapilla* L. na području Kisorosz (47° 47' N; 19° 03' E). Koristeći merističke podatke (dužina krila i repa) izvršena je analiza dužine krila, odnosno izračunata je regresija zašiljenosti krila u vreme seobe. Prikazujući biometrijske podatke analiziran je sastav i dinamika populacija u seobi. Na osnovu regresione analize utvrđena je razlika u ponašanju polova pri seobi.

## Об осеннем улёте *Sylvia atricapilla* в извилине Дуная

Г. Лёвей

Кафедра животноводства Университета им. А. Йожефа, Сегед

### Резюме

В лагере в Кйшороси при Венгерском птицеводческом Обществе (47°47'; 19°03'Е) в 1974—1976 гг. нами изучался осенний перелёт *Sylvia atricapilla*. Используя замеры крыла и хвоста, в нескольких повторностях проделали анализ, подсчитывая регрессию длины и заостренности крыла в зависимости от времени перелёта. На основании этого обсудили состав отлетающих славков, опубликовали биометрические данные. С помощью регрессионного анализа можно установить различие в поведении при перелёте различных полов.